

INSTITUTE OF TERRESTRIAL ECOLOGY  
(NATURAL ENVIRONMENT RESEARCH COUNCIL)

NCC/NERC CONTRACT HF3-03-430  
ITE PROJECT T08051h5

Annual Report to Nature Conservancy Council

ISLE OF MAY SEABIRD STUDIES IN 1990

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August 1990

## 2 METHODS

### 2.1 Breeding success

The methods used involved minimal disturbance of birds and are described in detail in 'Development of monitoring of seabird populations and performance' - Final Report to NCC for contract HF3-08-15.

**Fulmar:** The positions of apparently incubating birds were marked on photographs on 23 and 27 May and 2 June; sites where birds appeared to be incubating on all three visits, or where an egg was seen, were assumed to have been bred at. These sites were checked again on 17 July, and on 8 August when those with a large chick were assumed to have been successful.

**Shag:** The positions of nests in 14 areas were marked on photographs and the state and contents of these nests were checked weekly from early April until 22 August. Small young and eggs present at the last check are assumed to have failed for this report but their fate will be followed.

**Kittiwake:** The position of nests in 15 areas were marked on photographs and the presence or absence of an incubating bird, or the number of young present at each was checked on 23 May, 8 June and just after the first young had fledged on 20 July. Large chicks present at the last check were assumed to have fledged successfully.

**Guillemot, razorbill:** At least daily checks of the state of breeding of numbered nest-sites were made from permanent hides.

**Puffin:** Samples of burrows where an egg could be felt on 1-2 May (when most pairs had laid) were staked and rechecked on 2-3 July (when chicks were near fledging). All large young were assumed to have fledged as were young from empty burrows where there were many droppings, moulted down and feather sheaths.

**Common and arctic terns:** Nests with eggs were staked and counted and the cumulative total was taken as an estimate of the population. Regular checks were made of the number of young at or just after fledging present at the fringe of the colony.

### 2.2 Adult survival rates

These were based on sightings of individually colour-ringed birds in several parts of the colony. Searches were made for birds which had moved out of the study areas. These searches are extremely time consuming, and superficially unrewarding, but they are essential if accurate estimates of survival are to be obtained.

### 2.3 Food of chicks

Food regurgitated by young shags and kittiwakes and loads of fish dropped by adult puffins caught in mist-nest were collected, weighed and the fish identified and, where possible measured (total length to tip of tail). Where necessary, fish otoliths were extracted and examined. Records were kept of fish brought to young guillemots and razorbills and uneaten fish were collected from breeding ledges.

### 2.4 Feeding frequency

All-day watches were made of marked sites or burrows of guillemot, razorbill and puffin from permanent hides. Observers took 2 hr shifts, recorded the number of feeds brought to chicks and where possible noted the species and size of the fish brought to the young.

### 3 RESULTS

#### 3.1 Breeding success

Species accounts are given in Tables 1-4 and a comparison with recent year's results is shown in Table 5.

**Fulmar:** Breeding success was 0.24 young per incubating pair (compared to 0.31-0.54 in 1986-1989). The low success was due mainly to eggs failing or very small young being lost.

**Shag:** Many birds did not breed, or even construct nests and only two-thirds of those which did have nests laid. Breeding was extremely late. Breeding success was 0.30 young per incubating nest. This is under half the previous lowest recorded 1986-89.

**Kittiwake:** Breeding was late but most pairs laid. Many pairs left their eggs during a severe gale on 6-7 June. Most returned and continued incubation but eggs and young subsequently continued to be lost through the season. Chicks were often left unattended. Nesting success (at 0.17 young per completed nest) was the lowest ever documented on the island.

**Guillemot:** Breeding was a few days later than normal but success was high (0.78 young/breeding pair).

**Razorbill:** Breeding was slightly delayed but success was high (0.76 young/breeding pair).

**Puffin:** Breeding occurred at the normal time but success (0.66 young/egg laid) was the lowest since records began. Heavy rain during the chick period resulted in some burrows being flooded but for the first time dead young were found in, and out of, burrows.

**Terns:** The nest count of terns was 426 and the population was estimated at 450-500 pairs; about 60% were Arctic and 40% common. This is the highest total recorded for 40 years. Breeding success was extremely low with a maximum of 9 chicks (6 common and 3 Arctic) thought to have fledged (J. Calladine; details in Isle of May NNR Wardens' report for 1990).

### 3.2 Adult survival

Not every adult alive is seen each year and some probably do not return every season. Thus the survival figures in Table 6 are minimal. Even so, that recorded for guillemot is at the top end of the range of similar figures collected in previous years and at other colonies.

The apparent survival of puffins 1989-90 was exceptionally low despite considerable effort being put into looking for colour-rings and Chris Wernham attempting to catch all the puffins nesting in front of the Little Hide. Only time will tell whether many adults died or missed a year's breeding.

In 1990 2 (out of 15) kittiwakes seen in 1988 but not seen in 1989 were recorded, as were 10 (of 33) missing shags and 6 (of 21) missing puffins. Incorporating these records increases the 1988-89 survival figures for these three species to 92.1% (from 90.9%) 84.8% (from 77.3%) and 89.4% (from 85.2%), respectively.

Increases in the runs of data and the development of more powerful analytical techniques will allow us to improve these survival estimates but only several years after any given year's results have been collected.

During 1990 a further 19 kittiwakes 18 shags, 106 puffins and 64 guillemots were colour-ringed.

### 3.3 Food of young

Sandeels were by far the commonest food of young kittiwakes and shags, making up 86% and 95% of the diet (by weight), respectively (Table 7). Kittiwakes also regurgitated remains of very small Clupeidae, Gadidae and Gobiidae. Most sandeels were 7-10 cm long (i.e. young of the year).

Of the 493 fish which were identified as they were fed to young guillemots, 291 (59%) were sandeels; the remainder of the diet was made up of Clupeidae including both sprat (26 (48%) of Clupeidae specifically identified) and herring (28 (52%)) (Table 8). The bulk of the sandeels were small (6-8 cm) whereas clupeids were slightly larger (10 cm).

Razorbills brought large loads of sandeels 5-6 cm long with a few very small Clupeidae (Table 9). No other species were recorded.

Puffins fed their young almost entirely on small sandeels 7-8 cm long (Table 10). No sprats and very few herring were recorded. The mean weight of a load of fish was 8.5 g, which is the lowest recorded for 14 years.

### 3.4 Feeding frequency

Two all-day watches on different group of guillemot chicks and four on puffin burrows and razorbills sites indicated that the feeding frequencies of all three species were high (Table 11).

#### 4 CONCLUSIONS

4.1 The 1990 breeding season was, overall, the poorest for seabird breeding success since ITE started studies on the Isle of May in 1972. Common and arctic terns had a more-or-less complete breeding failure, kittiwakes produced only about 15% the usual number of chicks, many shags did not lay and those which did were extremely unsuccessful in fledging young, fulmar success was about half normal and puffins had their lowest recorded success. Guillemot and razorbill had 'normal' success (Table 5).

The first signs of reduced breeding success of Isle of May seabirds were recorded in 1988, but 1989 was again a successful season. The results obtained in 1990 reinforce the view that conditions for seabirds in the northern North Sea in general are now far from optimal. We must anticipate further problems.

4.2 Overwinter survival of shag, kittiwake, razorbill and puffin were the lowest since records have been collected (1986/7 for the shag and kittiwake, 1982/3 for Razorbill and 1973/4 for puffin). The apparent low survival of puffins is extremely worrying and if the missing birds do not return in 1991 (hopefully having just missed a season's breeding) then the population must decline. Other studies indicate that the population has been stable for the last 4-5 years. Studies of the survival of young puffins and their recruitment are urgently needed.

Guillemot survival remained very high although the population declined between 1989 and 1990. Ongoing studies indicate that recruitment has been very low in most recent years despite very high breeding success, and draw attention to the serious drawbacks in using solely breeding success as an indicator of the 'health' of populations.

4.3 Sandeel remained the stable food of all the species whose chick diet was monitored. Virtually all the sandeels eaten were 0-group, i.e. the young of the year, and therefore of fairly low calorific value. This is critical for the guillemot, which can carry back only a single prey item to its chick, and shag, which must spend considerable time swimming underwater and so needs to catch either a few large or several small fish each dive. Adult guillemots brought in substantial numbers of herring and sprat and breeding success was high, shags had a dismal breeding season so presumably could not cope with the apparent reduction in numbers, or availability of larger sandeels.

The reason for the food shortage for young kittiwakes, and young terns which casual observations indicate feed mostly small sandeels to their chicks, is not obvious but presumably these fish were not occurring at the sea-surface. Sandeel shortage for seabirds is certainly not restricted to Shetland.

4.4 The seabird studies on the Isle of May have been criticized in the past as being 'too academic' as they were concerned with populations which were expanding which indicated that food was abundant. However, we do have a solid base against which to assess changes in biology and survival which are now occurring in a range of species breeding on the island and elsewhere. Only by detailed studies in such circumstances can we hope to understand the processes, and hence the likely causes, involved in population declines and breeding failure.



## 5 ACKNOWLEDGEMENTS

John Calladine, NCC summer warden assisted with much of the work. Chris Wernham, A. Russell, H. Towll and many others helped collect fish from puffins and with the feeding watches.

## 6 PUBLICATIONS ON ISLE OF MAY SEABIRDS

The following have either been published within the last 12 months or are in press.

Harris, M.P. & Wanless, S. 1990. Molt and autumn colony attendance of auks. *British Birds* 83:55-66.

Harris, M.P. & Wanless, S. 1990. Breeding success of British kittiwakes Rissa tridactyla in 1986-88: evidence of changing conditions in the northern North Sea. *J. Applied Ecology* 27:172-187.

Harris, M.P. & Wanless, S. 1989. Fall colony attendance and breeding success in the Common Murre. *Condor* 91:139-146.

Harris, M.P. & Wanless, S. 1989. The breeding biology of Razorbills Alca torda on the Isle of May. *Bird Study* 36:105-114.

Harris, M.P. 1989. Variations on the correction factor read for converting counts of individual Guillemots Uria aalge into breeding pairs. *Ibis* 131:85-93.

Johnstone, J.G. Harris, M.P., Wanless, S. & Graves, J.A. 1990. The usefulness of pellets for assessing the diet of adult shags Phalacrocorax aristotelis. *Bird Study* 37:5-11.

Wanless, M.P. & Harris, M.P. 1989. Kittiwake attendance patterns during chick-rearing on the Isle of May. *Scottish Birds* 15:156-161.

Harris, M.P. & Wanless, S. in press. Population studies and conservation of Puffins Fratercula arctica. In 'Bird Population Studies' (eds. Perrins, Lebreton & Hiron). Oxford Univ. Press.

Harris, M.P. in press. Population changes in British Common Murres and Common Puffins 1969-1988 in 'Management of auk populations'.

Wanless, S., Burger, A.E. & Harris, M.P. in press. Diving depths of Shags Phalacrocorax aristotelis breeding on the Isle of May. *Ibis*.

Wanless, S., Harris, M.P. & Morris, J.A. 1990. A comparison of feeding areas used by individual Common Murres, Razorbills and a Puffin during the breeding season. *Colonial Waterbirds* 13:16-24.

- Wanless, S. Harris, M.P. & Morris, J.A. in press. Foraging range and feeding locations used by Shags Phalacrocorax aristotelis during chick-rearing. Ibis.
- Harris, M.P., Towll, H., Russell, A.F. & Wanless, S. in press. Maximum dive depths attained by auks feeding young on the Isle of May, Scotland. Scottish Birds.
- Harris, M.P. & Wanless, S. 1990. Breeding status and sex of Common Murres (Uria aalge) at a colony in autumn. Auk 107: 603-605.

**Table 1.** Fledging success of fulmars on the Isle of May in 1990.

| Area              | Incubating<br>birds | No. probably<br>hatched | Young<br>fledged |
|-------------------|---------------------|-------------------------|------------------|
| 1 Cleaver         | 8                   | 2                       | 1                |
| 2 Pilgrim's Haven | 2                   | 0                       | 0                |
| 3 Cornerstone     | 4                   | 1                       | 0                |
| 4 Loch (S)        | 23                  | 7                       | 7                |
| 5 Greengates      | 16                  | 3                       | 2                |
| 6 Horse Hole      | 5                   | 3                       | 3                |
| 8 Tarbet          | 6                   | 3                       | 3                |
| 9 Low Light       | 1                   | 0                       | 0                |
| 10 Colm's Hole    | 1                   | 0                       | 0                |
| TOTAL             | 66                  | 19                      | 16               |

0.24 fledged/pair

Notes: Incubating birds were those sitting tight on three checks or where an egg was seen. Chicks present on 8 August were assumed to have fledged.

No birds bred at Rona Site 7.

Checks were made by J. Calladine.

Table 2. Fledging success of shags on the Isle of May in 1990. The last check was made on 22 August.

| Area                 | Total incubated | Young fledged |   |   | Other nests | Total young fledged | Mean young fledged per incubated nest |
|----------------------|-----------------|---------------|---|---|-------------|---------------------|---------------------------------------|
|                      |                 | 1             | 2 | 3 |             |                     |                                       |
| 1 Lady's Bed (South) | 5               | 0             | 0 | 1 | 5           | 3                   | 0.60                                  |
| 2 Lady's Bed (Mid)   | 8               | 0             | 1 | 0 | 1           | 2                   | 0.29 <sup>1)</sup>                    |
| 3 Maidens            | 10              | 0             | 2 | 1 | 8           | 7                   | 0.70                                  |
| 4 South Horn         | 4               | 0             | 1 | 0 | 2           | 2                   | 0.50                                  |
| 5 Chatterstones      | 5               | 0             | 0 | 0 | 4           | 0                   | 0                                     |
| 7 South Face         | 3               | 0             | 0 | 0 | 2           | 0                   | 0 <sup>2)</sup>                       |
| 8 Mill Door (N)      | 14              | 1             | 1 | 0 | 3           | 3                   | 0.21 <sup>3)</sup>                    |
| 9 Mill Door (S)      | 14              | 0             | 3 | 1 | 9           | 9                   | 0.64                                  |
| 10 Bishops Cove      | 3               | 0             | 0 | 0 | 2           | 0                   | 0                                     |
| 11 Rona              | 6               | 0             | 0 | 0 | 18          | 0                   | 0                                     |
| 12 Tarbet            | 33              | 3             | 2 | 1 | 15          | 10                  | 0.30 <sup>4)</sup>                    |
| 13 Colm's Hole (S)   | 18              | 3             | 0 | 0 | 4           | 3                   | 0.17                                  |
| 14 Colm's Hole (N)   | 31              | 6             | 3 | 2 | 6           | 18                  | 0.58                                  |
| Mean $\pm$ SE        |                 |               |   |   |             |                     | 0.30 $\pm$ 0.07                       |

Notes: 1) One newly hatched on 22 August  
 2) One incubating on 22 August  
 3) One brooding small young on 22 August  
 4) Three brooding small young on 22 August.  
 5) Checks made by J. Calladine

Table 3. Fledging success of kittiwakes on the Isle of May in 1990.

| Area              | Completed<br>nests | Trace<br>nests | fledged/young<br>nest |    |   | Total<br>young<br>produced | Fledging success<br>per completed<br>nest | All pairs<br>(incl.<br>trace nests) |
|-------------------|--------------------|----------------|-----------------------|----|---|----------------------------|---|-------------------------------------|
|                   |                    |                | 0                     | 1  | 2 |                            |   |                                     |
| 1 Cleaver         | 31                 | 1              | 36                    | 4  | 1 | 6                          | 0.19                                      | 0.19                                |
| 2 Pilgrim's Haven | 27                 | 0              | 16                    | 7  | 4 | 15                         | 0.56                                      | 0.56                                |
| 3 South Face      | 34                 | 0              | 32                    | 1  | 1 | 3                          | 0.09                                      | 0.09                                |
| 4 Colony 4        | 128                | 14             | 116                   | 8  | 4 | 16                         | 0.13                                      | 0.11                                |
| 5 Cornerstone     | 127                | 1              | 103                   | 22 | 2 | 26                         | 0.20                                      | 0.20                                |
| 6 Loch (S)        | 129                | 10             | 129                   | 0  | 0 | 0                          | 0   | 0                                   |
| 7 Loch (N)        | 108                | 0              | 108                   | 0  | 0 | 0                          | 0   | 0                                   |
| 8 Greengates*     | 140                | 2              | 112                   | 27 | 1 | 29                         | 0.21                                      | 0.20                                |
| 9 Bishops Cove    | 64                 | 5              | 62                    | 2  | 0 | 2                          | 0.03                                      | 0.03                                |
| 10 Horse Hole     | 10                 | 0              | 8                     | 2  | 0 | 2                          | 0.20                                      | 0.20                                |
| 11 Iron Bridge*   | 59                 | 4              | 49                    | 10 | 0 | 10                         | 0.17                                      | 0.16                                |
| 12 Rona           | 54                 | 1              | 36                    | 17 | 1 | 19                         | 0.35                                      | 0.34                                |
| 13 Tarbet         | 156                | 11             | 134                   | 21 | 1 | 23                         | 0.15                                      | 0.14                                |
| 14 Low Light      | 67                 | 7              | 58                    | 8  | 1 | 10                         | 0.15                                      | 0.14                                |
| 15 Colm's Hole    | 15                 | 1              | 14                    | 1  | 0 | 1                          | 0.07                                      | 0.06                                |
| Mean              |                    |                |                       |    |   |                            | 0.17                                      | 0.16                                |
| SE                |                    |                |                       |    |   |                            | 0.04                                      | 0.04                                |

Notes: No broods of three were fledged anywhere on the island.

\*slightly different photographs from 1989

Checks were made by M. Towll and M.P. Harris

Table 4. Breeding success of auks on the Isle of May in 1990.

| Species   | Area        | Pairs<br>laying | Young<br>hatched | Young<br>'fledged' | Young<br>leaving/<br>pair |
|-----------|-------------|-----------------|------------------|--------------------|---------------------------|
| Guillemot | Dense       | 258             | 227              | 213                | 0.83                      |
|           | Hide/White  | 85              | 73               | 67                 | 0.79                      |
|           | Colony 4    | 225             | 185              | 175                | 0.78                      |
|           | South       | 43              | 32               | 28                 | 0.65                      |
|           | Cornerstone | 137             | 120              | 116                | 0.85                      |
|           |             |                 |                  |                    | Mean 0.78                 |
| Razorbill | Hide/White  | 19              | 14               | 14                 | 0.74                      |
|           | Colony 4    | 33              | 21               | 20                 | 0.61                      |
|           | South       | 12              | 8                | 8                  | 0.75                      |
|           | Cornerstone | 36              | 35               | 34                 | 0.94                      |
|           | Total       | 100             | 78               | 76                 | 0.76                      |
| Puffin    | Lady's Bed  | 47              | ?                | 31                 | 0.66                      |
|           | Kirkhaven   | 46              | ?                | 38                 | 0.83                      |
|           | Burrian     | 45              | ?                | 22                 | 0.49                      |
|           | Rona        | 38              | ?                | 25                 | 0.66                      |
|           | Total       | 176             |                  | 116                | 0.66                      |

Table 5. Breeding success (young reared per pair breeding) of some seabirds on the Isle of May 1986-90.

| Species   | 1986       | 1987       | 1988       | 1989       | 1990       |
|-----------|------------|------------|------------|------------|------------|
| Fulmar    | 0.53(79)   | 0.47(69)   | 0.31(64)   | 0.54(93)   | 0.24 (66)  |
| Shag      | 0.75(223)  | 1.09(288)  | 0.61(221)  | 1.09(234)  | 0.30 (154) |
| Kittiwake | 1.33(1133) | 1.09(1291) | 0.82(1278) | 1.11(1327) | 0.17(1095) |
| Guillemot | 0.82(785)  | 0.76(800)  | 0.85(732)  | 0.85(757)  | 0.78(748)  |
| Razorbill | 0.72(84)   | 0.71(64)   | 0.70(98)   | 0.74(97)   | 0.76(100)  |
| Puffin    | 0.80(136)  | 0.93(62)   | 0.89(157)  | 0.88(164)  | 0.66(176)  |

Notes: The number of pairs followed is given in brackets. Details of methods, etc. can be found in this and previous reports to NOC.

**Table 6.** Annual survival of adult seabirds on the Isle of May 1989-90.

| Species   | No. alive in<br>1989 | No. seen in<br>1990 | % Survival |        |        |
|-----------|----------------------|---------------------|------------|--------|--------|
|           |                      |                     | 1989/90    | 1988/9 | 1987/8 |
| Shag      | 169                  | 125                 | 74.0       | 78.1   | 77.3   |
| Kittiwake | 178                  | 140                 | 78.7       | 90.9   | 86.0   |
| Guillemot | 377                  | 357                 | 94.9       | 92.4   | 91.5   |
| Razorbill | 68                   | 51                  | 75.0       | 90.5   | 88.1   |
| Puffin    | 177                  | 112                 | 63.3       | 85.2   | 76.1   |
|           |                      |                     |            |        | 81.2   |

- Notes 1. Only birds which had definitely bred in 1989 or earlier are included.  
2. Directly comparable figures for adult survival in earlier seasons are given. These have not been corrected for missing birds seen in later years, and so are serious underestimates of survival.  
These figures should not be used for population dynamic calculations without consultation with M P Harris  
3. Details of earlier estimates are given in previous reports to NCC.



**Table 7.** Food fed to young kittiwakes and shags on the Isle of May in 1990.

|                                      | Kittiwake  | Shag                                 |
|--------------------------------------|--|--------------------------------------|
| No. of regurgitations                | 9  | 20                                   |
| Range of dates                       | 1 June-26 July   | 6-20 July                            |
| Total weight (g)                     | 210  | 570                                  |
| % regurgitations with sandeels       | 100  | 100                                  |
| % (by weight) of sandeels in sample  | 86   | 95                                   |
| % (by numbers) of sandeels in sample | 87   | 99                                   |
| Lengths (cm) of majority of sandeels | 7-9  | 8-10                                 |
| Other prey remains                   | 4 small Clupeidae<br>2 small Gadidae<br>9 small Gobiidae | 2 minute crabs<br>3 minute crustacea |

Note: Samples collected from chicks or adults brooding chicks  
Counts of fish were based on otoliths in the regurgitations

**Table 8.** Food of young guillemots on the Isle of May in 1990

|               | minute/<br>larval | Number of sandeels |        |       | Number of clupeidae |        |       |
|---------------|-------------------|--------------------|--------|-------|---------------------|--------|-------|
|               |                   | small              | medium | large | small               | medium | large |
| Length (cm)   | 6                 | 8                  | 12     | 16    | 8                   | 10     | 12    |
| 17 June       | 43                | 66                 | 12     | 2     | 4                   | 51     | 21    |
| 24 June       | 10                | 20                 | 11     | 3     | 8                   | 10     | 3     |
| Other days    |                   |                    |        |       |                     |        |       |
| 26 May-9 July | 33                | 70                 | 26     | 5     | 11                  | 48     | 36    |
| TOTAL         | 86                | 156                | 49     | 10    | 23                  | 109    | 60    |

Notes: 1) There were also two minute and one small (10 cm) Gadidae  
 2) Lengths were based on visual estimates against the bird's bill  
 checked by samples of dropped fish collected from the breeding  
 ledges.

**Table 9.** Food of young razorbills on the Isle of May in 1990.

|               | Number of loads of |        |                  |       | Clupeidae |
|---------------|--------------------|--------|------------------|-------|-----------|
|               | single sandeel     |        | several sandeels |       |           |
|               | large              | medium | medium           | small |           |
| Length (cm)   | 10                 | 6      | 6                | 5     | ?         |
| 17 June       | 2                  | 0      | 8                | 28    | 0         |
| Other dates   |                    |        |                  |       |           |
| 4 June-7 July | 0                  | 1      | 3                | 21    | 2         |
| TOTAL         | 2                  | 0      | 11               | 49    | 2         |

- Notes 1) Results from 17 June came from all-day watches of chicks  
 2) The clupeids were single small and very small fish, probably herring  
 3) 1 load contained small sandeels and clupeids

Table 10. Food of young puffins on the Isle of May 1990.

|   | Sample<br>size | Mean | S.E. |
|---|----------------|------|------|
| a) Load weight (g)                            | 110            | 8.5  | 0.38 |
| b) Fish/load                                  | 110            | 5.5  | 0.37 |
| c) Numbers and lengths of fish (mm)           |                |      |      |
| Sandeels <u>Ammodytes</u> sp.                 | 562            | 78.9 | 0.78 |
| Herring <u>Clupea harengus</u>                | 11             | 83.9 | 3.78 |
| Rockling probably <u>Gaidropsarus ciliata</u> | 6              | 33.5 | 1.26 |
| Saithe <u>Pollarchius virens</u> *            | 19             | 53.5 | 3.11 |
| *includes 4 unidentifiable small Gadidae      |                |      |      |

**Table 11.** Feeding frequencies of young auks on the Isle of May in 1990

| Species   | Date    | No. of young | Mean ( $\pm$ S.D.) feeds/chick/day |
|-----------|---------|--------------|------------------------------------|
| Guillemot | 17 June | 100          | 6.5                                |
|           | 24 June | 26           | 5.7 $\pm$ 1.7                      |
| Razorbill | 17 June | 10           | 6.9                                |
| Puffin    | 26 June | 35           | 6.2 $\pm$ 3.6                      |
|           | 3 July  | 34           | 5.0 $\pm$ 2.2                      |
|           | 8 July  | 32           | 5.0 $\pm$ 2.8                      |
|           | 15 July | 21           | 3.3 $\pm$ 2.3                      |

- Notes 1) Based on all-day watches by observers taking 2 hr shifts
- 2) No S.D. estimate available for 17 June as the fish delivered were not assigned to specific chicks
- 3) Puffin feeding frequencies were from watches organised by C. Wernham